



Optimization of Computer Aided Teaching System for Packaging Design Major

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Abstract. In this paper, the teaching of packaging structure design is taken as the background. The computer-aided interactive teaching system of packaging structural design course is studied, and online problems in packaging structure teaching are initially solved. This system builds a virtual reality experience hardware system, which can support the demonstration of simulation design, and at the same time, virtual interactive control to achieve audiovisual feedback between the teacher and the learner. The system changed some experience devices for virtual reality software for real-time control, and the communication mechanism and interface between the device and the software platform were studied. By comparing the traditional teaching system with the mobile teaching system, the thesis analyzes the characteristics and advantages of the interactive teaching system of the packaging structure course and proposes a packaging design architecture system. The value of this research is mainly that virtual reality technology is a contemporary packaging structure for an innovation in the application of design teaching. Combining this technology with a mobile platform provides a more scientific and effective teaching method for packaging structure teaching. It will not only increase students' interest in packaging course but also enhance the innovative ability of students and keep up with the pace of the information age.

Keywords: Packaging Design; Computer-Aided; Teaching System Construction

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1 INTRODUCTION

With the continuous development of the social economy, people's economic strength is continuously enhanced, and their consumption power is continuously improved. In today's society, what consumers valued in the past was quality. Now, consumers value not only the quality of the

items but also the beautiful packaging of more and more important items [1]. In recent years, the packaging is not only to protect the goods but also to enhance the aesthetics of the goods. Xia et al. [2] pointed that the competition of various modern commodities has become the competition of packaging structure design. The packaging structure design is to choose the appropriate packaging materials, design the corresponding packaging structure for the items, and package them by the purpose of protecting them from damage during transportation and sales and maximizing the charm of the goods and attracting the attention of consumers. It can be drawn from the above definition that packaging design is based on the fundamental protection of commodities and promotes the sale of commodities [3]. That is to say, packaging design is an important manifestation of the value of commodities in a certain sense. Good packaging structure design can attract consumers' attention and arouse consumers' purchase motivation. This is another important role of packaging structure design.

Some European and American countries such as the United Kingdom, France, Germany, the United States, and Japan have a very high level of development in packaging structure design teaching software. Hsu et al. [4] showed that they also attach great importance to package structure design teaching. In the United States, more than forty colleges and universities have set up packaging majors and set up corresponding course, making the United States the country with the most remarkable results in advanced teaching of packaging design. The teaching of packaging design in European and American countries requires everyone to have the basic knowledge of packaging design as well as the necessary marketing and management knowledge so that they can deal with various problems after work. Japan pays more attention to the packaging of commodities than our country, but their packaging is not publicized, and there is no problem with buying and returning beads [5]. The emphasis on packaging structure design in Japan is mainly reflected in the design of the packaging box and the external colors and patterns of the packaging. Because of the new design of product packaging, it is loved by many consumers. Mazzoni et al. [6] pointed that two universities have opened packaging major, college has positioned the major as natural science, enough to see its importance. Generations, countries are constantly exploring the development of the teaching package. It used the software functions Structure Databases to achieve automatic carton packaging structure design, and describe the carton expansion diagram, design dimensions, output three-dimensional drawings, and single-sided carton production process. The software consists of three data entry, the user can either choose, contains 111 kinds of box-type, if you can reach the needs of users, users Production drawings can be drawn. Bilgin et al. [7] showed that users can choose cardboard materials or corrugated cardboard of different thicknesses according to the characteristics of the product. It is a professional product packaging design system. The system links post-printing operations with pre-printing operations and has many functions. However, this software is basically in the experimental stage because of some shortcomings in performance and is not commercialized. At present, there is a common problem in the software of carton packaging design in China. The overall re-development alone provides a drawing-level effect without investigating and delving from the design top and depth. Ai et al. [8] said that the applicability of the software is poor. The best way to solve this problem is to take into account the needs and requirements of production and process. It needs continuous efforts to overcome the shortcomings of domestic design software, solve the difficulties of carton software development, and develop software modules suitable for each process. The teaching methods of packaging structure design in art design colleges are still relatively backward. Most of them are hand-painted flat renderings and hand-made teaching methods. Because the process and results of packaging structure design are three-dimensional, the design and folding of different packaging structures are also three-dimensional dynamic, so the teaching effect of hand-painted flat renderings on blackboards is not intuitive enough to be easily understood by students [9]. Based on the above problems, this paper studies the interactive teaching system based on the mobile platform which based on the teaching of packaging structure design, and initially solves the problems encountered in the teaching of packaging structure design. Through the comparison of the traditional teaching system and the mobile terminal teaching system, the paper analyzes the characteristics and advantages of the interactive teaching system which based on the mobile

platform. It proposes a packaging design architecture based on the mobile platform. The design and implementation of the interactive teaching system based on the mobile platform carton packaging structure course were completed with Q3D and windows platforms.

2 COMPUTER-AIDED INSTRUCTION SYSTEM CONSTRUCTION ANALYSIS

2.1 System to Achieve Environmental and Functional Analysis

The traditional drawing method is mainly used in the conception stage of design. Designers draw design inspiration by drawing on paper with a pen. This method has relatively low requirements on the accuracy of the drawing, but it takes a long time to draw, and it is not easy to modify. If there is a problem or needs to be modified, the designer needs to redraw the entire solution. Drawings drawn by traditional methods have high artistic aesthetics, and they are also in line with people’s writing and drawing habits. However, designers need to have certain painting skills. The design concept is a preliminary idea that reflects the designer’s design plan. The drawing on the pen and paper gradually defines the design materials and design plan. It is also the process in which the designer gets inspiration during the design process and continuously optimizes the design plan.

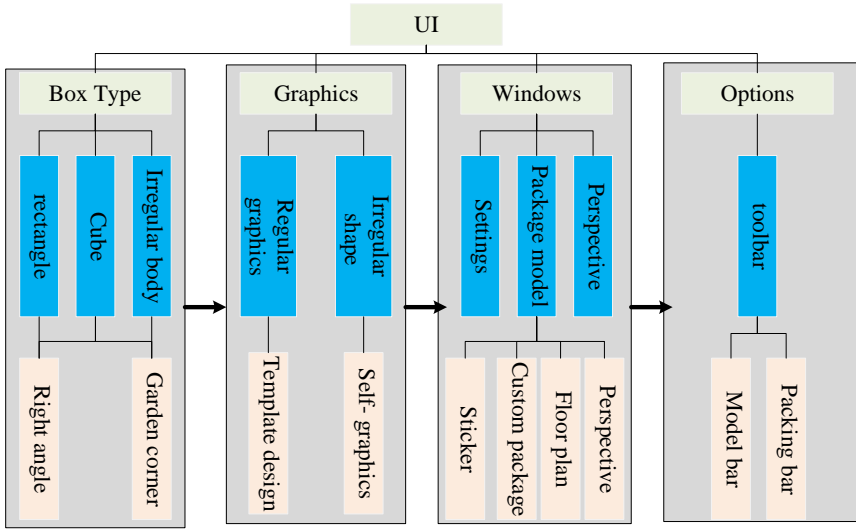


Figure 1: System functional structure diagram.

After the analysis of the whole system of the system, it may be used herein to determine the MVC architecture and method, and a B/S mode for system development and design of the auxiliary-operation, after analysis of the specific architecture shown in Figure 1. This structure diagram contains three levels of structure: presentation layer, logic layer, and a data layer. Through the development and design of this system, it can be used by managers. At the same time, the development system and the structure of the three-tier architecture are also very clear, and the operation is relatively simple, which can greatly reduce the workload of the package installation process. The main job is to use this interface to convert data to information. Commands can be entered into the system in machine language. This is very critical for the presentation layer, as shown in Figure 2. Users can use this layer directly, while also Need to consider the simplicity of the entire interface. The logic layer mainly operates and processes the data layer, issues operational commands through the presentation layer and then processes the data. After the data

are obtained from the data layer, the data can be fed back to the presentation layer, and the user can see the obtained data at the presentation layer.

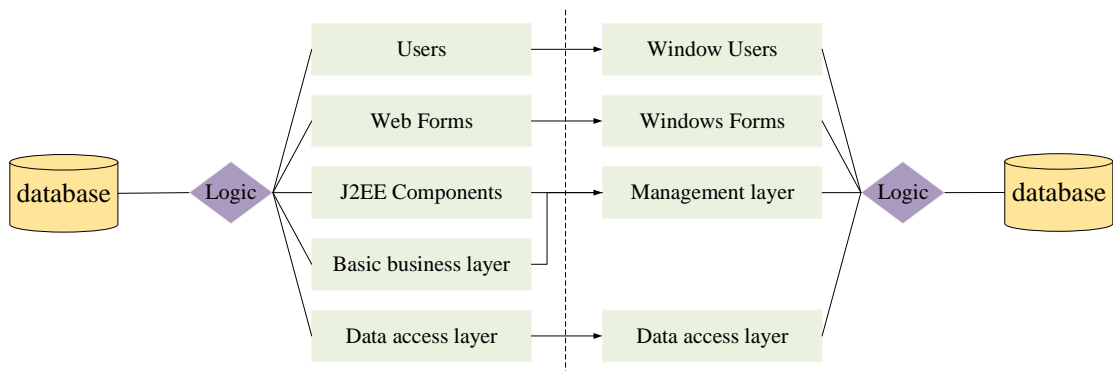


Figure 2: Software architecture.

2.2 System Design and Feasibility Analysis

The interface of the system is mainly the database interface. The realization of the database interface is mainly that the user can operate and process the data information, complete the operation of adding, deleting, and searching through standard database statements. When implementing the interface, you need to use the button control to complete the database information and corresponding operations. There are the following specific parts. User-operated interface. This interface is mainly composed of two parts. One is the verification interface of the user's personal information. After verification of the information data, the user can determine whether the data information is correct. A management interface for the data information is needed, which is user with authority can perform basic operations of adding, deleting, and searching data information. In the system as a function of internal system registration and authentication, the user registration function and by applying the input operation of the page, the user can fill in the corresponding data in its page, and then stored in the system database. The authentication interface data will perform corresponding authentication processing on personal data and information. The system also needs to design an external processing interface. This external interface includes the design interface of the hardware and software, so it needs to be fully considered. The hardware interface is mainly connected to the database of the system. The software interface can be installed and used in the system. The system database includes user entities, teaching materials entities, question bank entities, course entities, process recording entities, student achievement entities, and answer information entities. In this design, the requirements are analyzed in detail. According to the system database and the functional structure of the system, various entity-relationship ER diagrams of employee needs can be drawn according to the actual current situation. The system entity-relationship ER diagram is shown in Figure 3. According to the ER diagram, it can be analyzed that the system is mainly composed of administrators, teachers, and students, and the relationship between them can be reflected through the E-R diagram.

When designing the database, it was determined that the database included the user's basic information table, login information table, course information table, system management table, student exam table, teaching data table, student score table, etc. The user's basic information is used to manage the data of the participating users, mainly including the user's code, name, gender, hometown, political appearance and other related data information, where the user code is the primary key. Among them, User_ID is Int type, Stu_name, Stu_sex, and Stu_jg, Pol_sta are Varchar types, and their structures are shown in Table 1 according to the analysis.

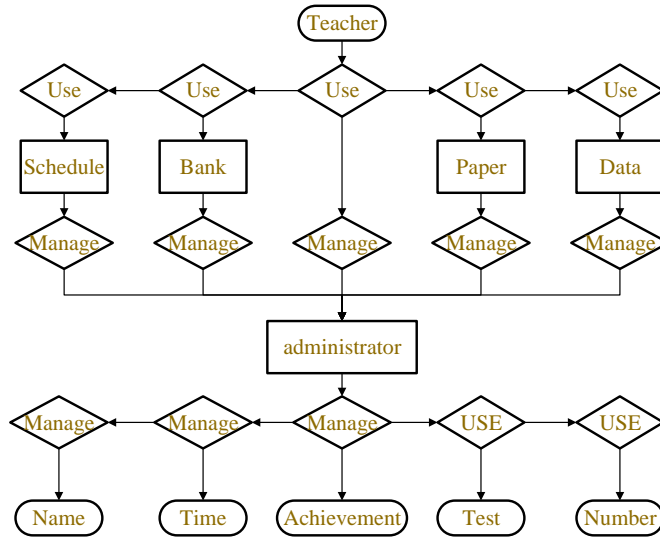


Figure 3: Diagram of E-R System.

Field name	Types	Length	Description	Primary key
K_D	Int	15	Course D	Yes
K_name	Varchar	21	Course Title	no
K_type	Varchar	32	Course type	no
K_size	Varchar	26	Course size	no
K_FB	Varchar	14	Course Publisher	no
G_ID	Int	23	Operation number	Yes
G__Back	Varchar	42	Backup options	no
G_Restore	Varchar	11	Restore selection	no
G_Guan	Varchar	25	Authority management	no

Table 1: Course Information Table and System Management Table.

After designing several sets of schemes, the simple and stylish tone from the beginning was changed to the style that simulates the design of the real space and has undergone many modifications. The design of the interface uses virtual reality as the main method, using the three-dimensional model as the main object of expression, and expresses the different designs of each interface by changing the packaging style. The simple monochrome prompt box gives the interface a simple and practical feel. Most of the whole work is made and designed using three-dimensional models of virtual reality, giving people a real feeling. The knowledge point-practice distribution matrix has the following definition. The teaching platform contains a total of exercises and knowledge points. The row in column represents the sequence of all topics, and the column represents the sequence of all knowledge points.

$$W_{5*4} = \begin{bmatrix} 1 & 1 & 0 & 1 \\ 0 & 1 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{bmatrix} \tag{1}$$

It means that the first question contains the first, second and fourth knowledge points, the second question contains the second and third knowledge points, the third question only has the fourth knowledge point, and the fourth question contains the first and third knowledge points. The fifth question contains the first, second, third and fourth knowledge points. Only two kinds of values represent the I question contains the j-th known content knowledge points. The knowledge point score rate sequence, combined with the total exercise sequence is done by a student i in Definition. The correct exercise sequence RSi knowledge point-exercise distribution matrix Vm in the student exercise, defines the knowledge point score rate:

$$M_j = \frac{\sum_{i,j=1}^{m,n} R_i V_{ij}}{\sum_{i,j=1}^{m,n} E_i V_{ij}} \quad (2)$$

Back-end development is using the popular PHP framework thinkPHP3.2 version. Rack provided on sina cloud platform design model of the whole micro-letter applet using Web development widely used MVC design. MVC is a design pattern for web application architecture. Many large enterprise projects have adopted this design pattern. Its design pattern is an innovative web development method that separates the front and back ends, making interface development only interface development. The business logic development only focuses on the logic itself, but the business logic in a single component, separate the personalized custom interface from the business logic when the user interacts, and develop at the same time, which greatly increases the development efficiency.

3 RESULTS ANALYSIS

3.1 Accuracy Analysis

To verify the effectiveness and accuracy of the algorithm, this paper first calculates the student's knowledge point score rate matrix, and on this basis, derives the evaluation indicators recommended by the exercises based on the knowledge graph. According to the test set, the exercise recommendation algorithm proposed in this paper is compared with the traditional content-based recommendation method, collaborative filtering algorithm, and probability matrix decomposition algorithm, and it is found that the exercise recommendation algorithm in this paper recommends better performance. The knowledge point-scoring rate sequences of some students are shown, showing four students of knowledge point-scoring rate sequences, including the original student knowledge point-scoring rate and the knowledge point-scoring rate sequence after adding the knowledge point importance ranking algorithm. Compared with the original score rate sequence, the gap between score points of the students' knowledge points on different topics is reduced. Compared with other knowledge points, some of the four knowledge points in the student's knowledge point score rate sequence has a strong correlation. Belonging siblings, it is known with a different student little knowledge gap scoring rate point from different angles of view of students, almost scoring rate varies, a big gap. Exercises recommended experimental accuracy, as showed in Figure 4.

As can be seen from Figure 5, the accuracy rate of the initial recommended questions is very high. When the number of questions increases, the recommended content ranges from the inclusion relationship to the sibling relationship to the connection less relationship. The type is getting harder and harder, and the chance of getting it right is smaller, but the accuracy of the recommendation is still very high. This experiment is to process the data in the data collection platform offline, so the experimental results are ideal. It verified the performance of the problem recommendation algorithm which based on knowledge graph and other algorithms.

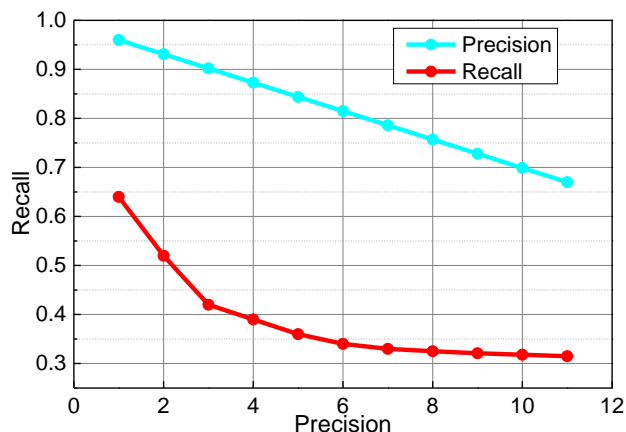


Figure 4: Accuracy and recall rate.

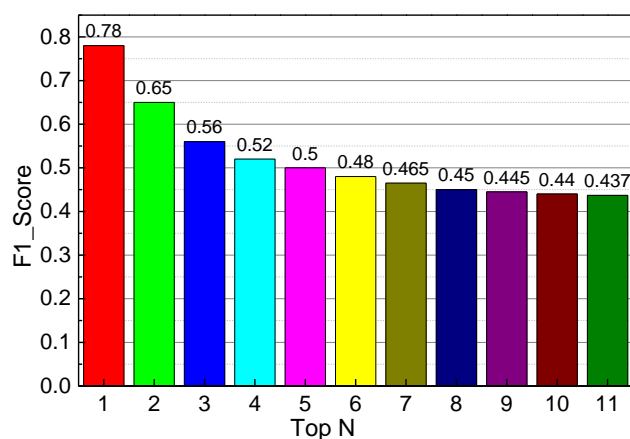


Figure 5: The value of F1.

This paper proposes a knowledge point importance ranking algorithm based on the knowledge graph, which is also applied to the problem recommendation of an education platform. Based on this, a problem recommendation algorithm based on the knowledge graph is proposed. The knowledge point importance ranking algorithm is used to completely solve the problem of user cold start when doing exercise recommendation in the education platform, and based on the learner's learning data, a set of exercise recommendation algorithm based on knowledge graph is made, which is closely integrated The learner's problem-recording data. It sets the recommendation interval function, and combined the knowledge point importance ranking algorithm based on the knowledge graph, which improves the recommendation effect of the learner's personalized recommendation algorithm, and provides a recommendation for the exercises in the education platform. To achieve a multi subject wisdom education service platform, data sources and ways to increase the education of large data, such as C language platform, university physics flat stage, probability theory Peas cloud platform, and assistant platform, and assistant to the cloud platform. The intelligent push function is shown in the experiment of this article is shown. This function is based on the exercise algorithm proposed in this article, combined with the data of each student's practice, to realize intelligent push function of personalized exercise.

3.2 System Test Analysis

A total of 50 e-learning users participated in this test. Of all users, 40 were students and 10 were e-learners who graduated from colleges and universities within two years. The test recovered 44 valid questionnaires, 38 from college students, and 6 graduates within two years. The statistics of the online learning background of learners participating in the survey are shown in Figure 6. In the survey of the basic information section, of the 35 learners with experience in learning to use packaging, it believed that learning packaging helped them strengthen their understanding of their learning.

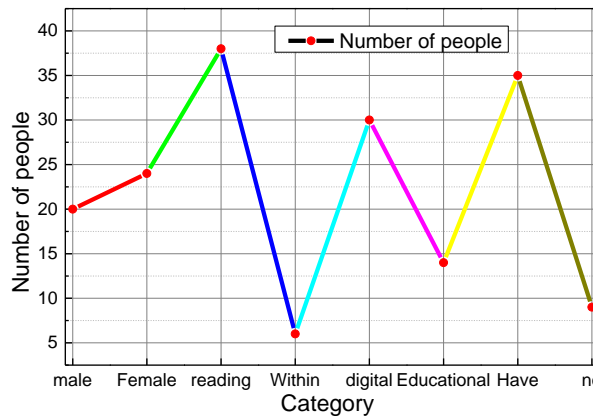


Figure 6: Statistics of learners' online learning background.

All statements in the scale are in a positive tone. The higher the statement score, the higher the learner's approval of the corresponding components of the statement. In a survey of usability, legibility, and drive for learning packaging, the author compared the average score of each statement. The usability score is the visual representation statement score, and the driving score is the active guidance statement score, with a perfect score of 5 points. The legibility score is obtained by adding the scores of the two statements of comprehension and cognitive efficiency to a full score of 10. As shown in Figure 7, learners judge that the usability of the learning package is high, the level of understanding of the chart is high, and the perception of the driving force of learning change is moderately low. As can be seen from the scores of each component, the learners believe that the design of the learning package in the project uses a visual chart that fits the content of the learning analysis, and they can well understand and remember the information transmitted by the chart. However, based on accurate understanding and cognition, learners are not motivated to change their learning behaviors and methods.

It has received a very high evaluation in terms of usability. Among them, the learning time and the test situation are at the forefront of the three scores. In the final statistics of the questionnaire, the score is the most popular among learners. The login situation failed to enter the top three. Based on the results of the interview, the author analyzes that the reason for this result is that histograms, bar charts, and line charts are more common than other data charts, and learners accept quickly and understand easily. The ranking of the favorite degree is different from the score. This is because compared to the login situation that is greatly influenced by external factors, the changes in learning time and test scores are more subjectively affected by the learner. Analyzing information leads to one-on-one thinking. Although chart teaching is provided, accurate understanding of word clouds and network charts still requires chart reading experience support, and their intermediate scores are also explained.

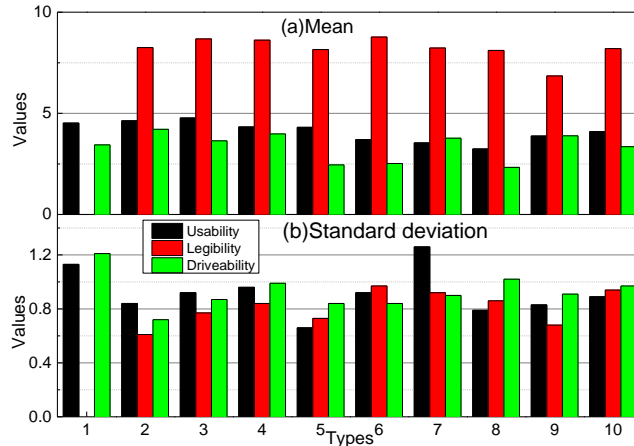


Figure 7: Learning the scores of various components of packaging design.

In the process of implementation, Web files can display information such as courseware and teaching videos. The system can perform a comprehensive evaluation based on the user's learning level. At the same time, the system will automatically record data information, and then automatically provide reference materials based on the student's learning level. The difficulty of recommending course materials is related to the learner's ability. The comparison between the difficulty coefficient and the learner's ability is shown in Figure 8.

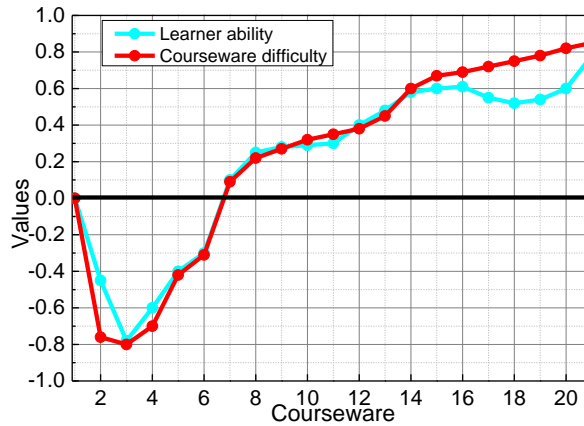


Figure 8: Evaluation of courseware recommendation effect.

Using Load Runner 11 tools for performance testing, test server hardware for the 4-core 8G memory, software environment, using Load Runner to access web pages form a script, the script set access server-side interfaces and return to the start of the call returns set transaction. The transaction opened labor quota standard maintenance pages. Affairs is calculated threading time quota and create 1000 virtual users and lead them gradually. The average response time of transaction is shown in Figure 9.

It designed and implemented a computer-aided quota management system. Theoretically, a computer description method for working time quota standards is proposed. The description method includes a set of parameter declarations and assignment statements, which can perform

expression calculations, support parameter lookup tables, etc., and can fully express the work time quota standards set by the enterprise.

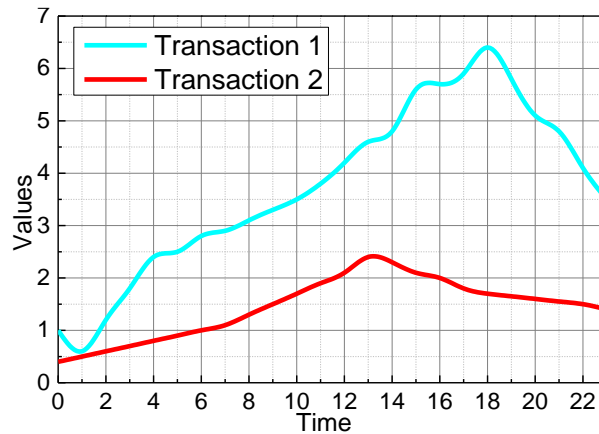


Figure 9: The average response time of transaction 1 and transaction 2 in Load Runner.

The core of the working time quota standard parser is the analysis of expressions. The algorithm of the expression parsing engine is designed based on the Interpreter mode, and the design of the working time quota standard parser is completed [10]. In the system design, the classic three-tier architecture is used to explain all aspects of system design, such as the business logic layer and data access layer class design, database design, Web Services interface design, object interaction design, etc. In terms of system implementation, the Web system is implemented using toolkits such as ASP.NET ajax control toolkit and functions that require more interactive work time quotas. It used Developer Express UI controls, and access Web Services interface interacts with the server. The realization of the system was demonstrated, and the function, compatibility, and performance test of the system was introduced. After the actual use of the enterprise, this article system has improved the science and efficiency of the enterprise's working hour quota, achieved good results, and embodies good practicality.

4 CONCLUSION

Computer-Aided interactive teaching system based on a combination of Q3D technology and virtual reality technique, developed a three-dimensional teaching system used in carton packaging structure design, the system uses Q3D and windows development platform, application development software, 3ds Max enables the designer to perform simulated operations in a virtual working environment, making the design process more intuitive and easier to modify. At the same time, it promotes the interaction between the designer and the teacher, making it easier for the designer to obtain the corresponding knowledge. Compared with the traditional teaching system, the teaching effect of this system is more intuitive, and the knowledge taught by students makes it easier for students to understand, which solves the bottleneck of packaging structure design teaching for many years. This system builds a virtual reality experience hardware system, which can support the demonstration of simulation design, and at the same time, virtual interactive control to achieve audiovisual feedback between the teacher and the learner. The system changed some experience devices for virtual reality software for real-time control, and the communication mechanism and interface between the device and the software platform were studied. As a new term in the new era, virtual product packaging structure design has a broader space for development in this field. With continuous research and development of this technology, it will bring continuous progress to the industry of product packaging structure design. The main reason for focusing on the user's experience side is the product packaging structure design modeling. The

reason for economic development and social development is that social and economic development is a certain development trend; the designer's thinking is the main core of virtual product packaging structure design.

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